## REMARKS

This is in response to the Office Action dated July 22, 2005 in which claims 1-17 and 29-38 were rejected. With this Amendment, claims 1, 7, 11, 29, 32, and 36 are amended and claims 2 and 13 are canceled. Claims 1, 3-12, 14-17 and 29-38 are pending in this application.

Amendments to Claims 7 and 32

With this Amendment, claims 7 and 32 were amended to recite that the tunnel barrier comprises $Ti_xAl_yO_z$, wherein x, y, and z are greater than zero.

Amendment to Claim 36

With this Amendment, claim 36 has been amended to provide proper antecedent basis for the term "dopant" based upon the amendment of independent claim 29 from which claim 36 depends.

Claim Rejections - 35 U.S.C. § 102

In the Office Action, claims 1 and 7-10 were rejected under 35 U.S.C. § 102(b) as being anticipated by the Parkin patent (U.S. Patent No. 5,764,567), and under 35 U.S.C. § 102(e) as being anticipated by the Hasegawa patent (U.S. Application No. 2003/0035255).

With this Amendment, independent claim 1 has been amended. Claim 1 now includes a first ferromagnetic layer, a tunnel barrier layer comprising a titanium alloy oxide, and a second ferromagnetic layer, wherein the tunneling magnetoresistive stack exhibits a negative exchange coupling between the first ferromagnetic layer and the second ferromagnetic layer.

Neither the Parkin patent nor the Hasegawa patent discloses each and every element of amended independent claim 1. The Office action at page 3, number 6, confirms that neither the Parkin patent nor the Hasegawa patent disclose "the material of the tunnel barrier." Since neither the Parkin patent nor the Hasegawa patent disclose a tunnel barrier comprising titanium alloy oxide, they do not anticipate claim 1, and independent claim 1 is in condition for allowance. Claims 7-10 depend from allowable independent claim 1, and are also in condition for allowance.

Claim Rejections - 35 U.S.C. § 103

Claims 2-6, 11-17, and 29-38 were rejected under 35 U.S.C. § 103(a) as being obvious over the Parkin patent or the Hasegawa patent in view of the Carey patent (U.S. Patent No. 6,756,128) or the Chen patent (U.S. Patent No. 6,183,859). The Office Action states that neither the Hasegawa patent nor the Carey patent disclose the material of the barrier layer. However, the Office Action states that the material would be obvious in light of either the Carey patent or the Chen patent.

With this Amendment, claims 2 and 13 have been canceled. Independent claims 11 and 29 have been amended. Claim 11 now recites first and second ferromagnetic layers and a tunnel barrier layer, wherein the tunnel barrier layer is an oxide of a titanium alloy, and wherein the tunneling magnetoresistive stack exhibits a negative exchange coupling between the first ferromagnetic layer and the second ferromagnetic layer. Claim 29 now recites a first ferromagnetic layer having a first magnetization direction, a second ferromagnetic layer having a second magnetization direction opposite the first magnetization direction, and a tunnel barrier layer, wherein the tunnel barrier layer is an oxide, nitride, or oxynitride of a titanium alloy. (For simplicity, oxide, nitride, or oxynitride will be referred to generally as an oxide below.)

Neither the Parkin patent nor the Hasegawa patent teach or suggest an oxidized titanium alloy could be used as a tunnel barrier to achieve negative exchange coupling within a tunneling magnetoresistive stack. Rather, the Parkin patent and the Hasegawa patent primarily address a barrier layer made of $Al_2O_3$. (*See* Hasegawa ¶ 115 and Parkin col. 7, line 67.)

The exchange coupling data of Table 1 of the present application is useful in illustrating the difference that exists between a barrier material of $Al_2O_3$ and a barrier material of Ti-Al-O. Table 1 illustrates various exchange coupling values for three different barrier materials. It is shown that a TMR stack with either an $Al_2O_3$ barrier or a $TiO_x$ barrier results in a positive exchange coupling value. However, a barrier constructed with Ti-Al-O resulted in a negative exchange coupling value. Nevertheless, even if the Parkin or Hasegawa disclose negative exchange coupling using an $Al_2O_3$ barrier material, they do not

teach or suggest a tunneling magnetoresistive stack with an oxidized titanium alloy barrier exhibiting negative exchange coupling.

Furthermore, neither the Chen patent nor the Carey patent teach or suggest that an oxidized titanium alloy could be used as a tunnel barrier to achieve negative exchange coupling within a tunneling magnetoresistive stack. In the abstract, the Carey patent states "[t]he Ti barrier material can be alloyed with other known metals, such as Al and Mg, to produce barriers with $TiAlO_xN_y$ and $TiMgO_xN_y$ compositions." The Chen patent states that "[i]n a preferred embodiment, the dominant element is aluminum and the trace materials can be any or all of Cu, Si, Ta, Ti, or the like." (Col. 3, lines 53-57.) The Chen patent also states that "the seed material includes one or more of Cu, Si, Ta, Ti, or the like and the dominant material includes aluminum." (Col. 3, line 67 - col. 4, line 2.) Nowhere in these patents does it suggest that the materials could be used to create a tunneling magnetoresistive stack with negative exchange coupling. Therefore, independent claims 11 and 29 are in condition for allowance.

Dependent claims 3-6, 12, 14-17, and 30-38 all depend from allowable independent claims 1, 11, and 29 respectively, and are therefore allowable.

**Conclusion**

In view of the foregoing, this application containing pending claims 1, 3-12, 14-17, and 29-38 is in condition for allowance. Reconsideration and notice to that effect is respectfully requested.

Respectfully submitted,

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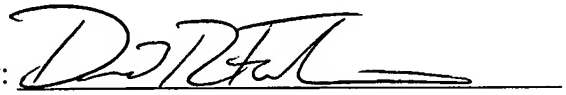
By: 

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